REMARKS

Claims 1-16, 19-38, 40-41, 43-51, 53, 84-85, 90-93, 95-112, 114-116, 118-126 and 128 are pending in the present application.

Applicants request reconsideration of the present application in view of the following remarks.

The Rejections

Claims 1-16, 19-24, 37-38, 40-41, 43-51, 53, 84-85, 90-93, 95-100-112, 114-116, 118-126 and 128 stand rejected. Solely for the Examiner's benefit, the rejected claims can be considered in the following groups:

(1) independent claims 1 and 2, and dependent claims 3-16, 19-24, 25-36, 38, 53, 84-85, 90-93, 95-112, 114 and 128, which recite an organic, small pore area material comprising a monolithic aerogel in which its smallest dimension is greater than about 3 inches and is substantially free of cracks;

(2) independent claims 37 which recites a small pore area material comprising acetic acid; and independent claims 40 and 115, and dependent claims 41, 43-51, 116, 118-126, which recite a small pore area material (claims 40, 41 and 43-51) or a low density microcellular material (claims 115, 116 and 118-126) comprising carboxylic acid as a solvent.

Applicants respectfully note that the Examiner's present rejections are similar to those in the previous Office Action dated August 27, 2003. In response to that Office Action,

applicants submitted arguments for patentability of the claims. The Examiner considered applicants' arguments and withdrew the rejections. Applicants' arguments below are substantially based on those presented in the previous response. For at least these reasons, each group is allowable.

35 U.S.C. §102(b)

The Examiner has rejected claim 37 under 35 U.S.C. § 102(b) as allegedly being anticipated by United States Patent 5,789,338 ("Kaschmitter"). Applicants traverse.

Applicants' invention, defined by claim 37, is a small pore area material comprising acetic acid. By incorporating acetic acid into the small pore area material, the resulting material has increased strength. As stated in applicants' specification (page 54, lines 14-20):

> acetic acid is retained in the dried gel, even after extended drying. This suggests that it is strongly anchored to the network by hydrogen-bonding, or it would have evaporated during drying. This is consistent with [applicants'] hypothesis that acetic acid strengthens the gel by way of the hydrogen-bonding mechanism.

The Examiner contends that Example 5 of Kaschmitter discloses a small pore area material comprising acetic acid. Applicants disagree. The aerogel ***product*** disclosed in Kaschmitter does not comprise acetic acid. Rather, Kaschmitter discloses the use of *trifluoroacetic acid* as a catalyst in ***treating*** pre-formed aerogels. And, the trifluoroacetic acid does not remain in the aerogel product.

More specifically, Kaschmitter discloses a method for making aerogels by forming the aerogel in water in the presence of a base catalyst and then treating the formed aerogel with an acid-wash. Thus, the only context in which acetic acid is potentially mentioned in Kaschmitter is in the acid-wash step performed on the pre-formed aerogel. See, e.g., Kaschmitter, col. 10, lines 34-37. In this acid-wash step, trifluoroacetic acid (not acetic acid) is merely a catalyst in an acid-catalyzed condensation reaction to promote further crosslinking of the gel, ***after*** the gel is formed. Indeed, the Examiner acknowledges that the Kaschmitter "gel is ***treated***" with acetic acid. (Office Action at p. 2 (emphasis added)). Thus, although the ***process*** used to treat the gel uses *trifluoroacetic acid* as a catalyst, there is no teaching whatsoever that the ***product*** disclosed comprises *acetic acid*, as required by claim 37. Nor would one expect a catalyst to form part of the final product, again as required by claim 37.

Accordingly, because Kaschmitter does not disclose a small pore area material comprising acetic acid, it fails to anticipate claim 37. Accordingly, the rejection under 35 U.S.C. § 102(b) should be withdrawn and claim 37 should be allowed.

35 U.S.C. §103(a)

Rejection of the Group 1 Claims

The Examiner has rejected claims 1-16, 19-24, 84-85, 90-93 and 95-100 under 35 U.S.C. § 103(a) as allegedly being unpatentable over United States Patent 6,005,012 ("Hrubesh") in view of United States Patent 6,087,407 ("Coronado"). Applicants traverse.

Claims 1 and 2

In brief, applicants' invention, as defined by claims 1 and 2, is a monolithic aerogel in which its "smallest dimension is greater than about 3 inches." As detailed below, the combination of Hbrubesh and Coronado does not teach or suggest applicants' aerogel. Also, there is no motivation to modify the references to produce applicants' aerogels. Even if the references could be so modified -- which they cannot -- there is no reasonable expectation of success in making larger aerogels. Therefore, the Examiner has not established a prima facie case of obviousness.

Applicants' invention, as defined by claims 1 and 2, is a monolithic aerogel in which its "smallest dimension is greater than about 3 inches" and is "substantially free of cracks." These aspects of applicants' invention render it with superior advantages over the organic aerogel monoliths produced prior to applicants' invention. For example, applicants' invention may be made for a wide variety of uses and applications in which thin sheets and films are impractical. The combination of Hrubesh and Coronado fail to teach or suggest an aerogel having the dimensions required by applicants' claims.

Hrubesh teaches a method of creating hydrophobic aerogels by treating pre-formed dried monolithic aerogels. (*See, e.g.,* Hrubesh abstract). The organic aerogels used in Hrubesh are prepared by the methods of Pekala, United States Patents 4,873,218, 4,997,804, 5,086,085, and 5,476,878 (hereinafter "the '218 patent," "the '804 patent," "the '085 patent," and "the '878 patent," or collectively as "the Pekala patents"; column 3, 35-47).

As the Examiner acknowledges, Hrubesh does not disclose a monolithic areogel having its smallest dimension greater than about 3 inches (Office Action, page 3, lines 14-15). Rather, the largest organic aerogel disclosed in Hrubesh has a smallest dimension of 1.5 centimeters (Hbrubesh Example 4). Thus, applicants' claimed monolothic aerogels have a smallest dimension that is over ***5 times*** larger than that of the Hrubesh aerogels. And, the Pekala patents, which describe the monoliths used in Hrubesh and are incorporated by reference in Hrubesh, do not teach or suggest an aerogel monolith in which its smallest dimension is greater than about 3 inches.

The failure of Hrubesh to teach or suggest a monolithic aerogel having a smallest dimension greater than about 3 inches is in no way cured by Coronado's teaching. Coronado discloses a method for making aerogels containing reinforcing fibers. According to the Examiner, the Coronado aerogels may be formed in various shapes. However, such "various shapes have a cross-section of 5 microns to ¼ inch and thicknesses ranging from 0.001" to 6.0". " Coronado, col. 4, lines 1-4. Thus, applicants' claimed monolothic aerogels have a smallest dimension that is over ***15,000 times*** larger than that of the Coronado aerogels.

Further, not only do Hrubesh and Coronado fail to teach all of applicants' claim elements, but there is also no suggestion to modify the references in the manner suggested by the Examiner. While Coronado generally teaches a flexible aerogel for use in aircraft, ice boxes and refrigeration (Coronado, Col. 2, lines 20-24), its specific teaching is limited to aerogels having a smallest dimension of 5 microns. Thus, a fair reading of Coronado in no way suggests aerogels having the dimensions required by applicants' claims. Therefore, Coronado

fails to provide the requisite motivation to make an organic aerogel in which its smallest dimension is greater than 3 inches.

Likewise, Hrubesh teaches away from an organic aerogel in which its smallest dimension is greater than 3 inches. Hrubesh describes monolithic aerogels of minimum dimension of 2 mm -- over *300 times* smaller than the smallest dimension of applicants' claimed monolithic aerogels -- as "relatively large." (Hrubesh, col. 7, lines 19-24). Thus, even if one were motivated to make a "large" monolithic aerogel, Hrubeth would teach that such monoliths are much smaller than applicants' claimed monoliths.

Moreover, at the time of applicants' invention, there was no suggestion in the knowledge generally available to the skilled artisan to produce larger monolithic aerogels. Indeed, in another Pekala patent, United States Patent 5,731,360, Pekala teaches away from doing so because it was not feasible to make such monoliths using the methods described in the '218, '804, and '085 patents:

> Although monolithic aerogels, either supercritically-dried or air-dried, are ideal candidates for many applications...the large and expensive processing equipment necessary for producing reasonably sized aerogels has limited the commercial application of this extraordinary material. The formation of aerogel microspheres or powders offers an attractive alternative to monolith production. (col. 1 lines 61- col. 2, line 2).

In other words, Hrubesh discloses aerogels produced by the Pekala's methods. Pekala, however, in this subsequent reference teaches away from using those very methods when producing large monolithic aerogels (*i.e.*, like those of applicants' invention) because such methods were not suitable. Indeed, for applications requiring larger materials, Pekala

teaches that alternative types of aerogels, not those of applicants' claims, should be used. Thus, even if a need existed for larger aerogels, there was no motivation to produce larger monolithic aerogels as opposed to microspheres or powders.

Further, there was also no reasonable expectation of success of making larger monolithic aerogels at the time of applicants' invention. Indeed, organic aerogels produced at that time were required to have at least one small dimension (*i.e.*, much smaller than 3 inches) because the available drying processes were inadequate to dry larger monoliths. The ability to dry a sol-gel is dependent on the size of the foam. A larger foam requires more intensive drying because of the longer distance the solvent must pass from the interior of the foam to the exterior. A sol-gel that is dried in a mold or container will require that the liquid travel through the sol-gel to the open surface of the mold or container in order for the liquid component to be removed. (page 9, line 29-page 10, line 4). Thus, the ability to dry a foam is limited by its smallest dimension (*i.e.*, the distance the liquid must travel to be removed).

At the time of applicants' invention, the available drying processes required that liquid had to travel through the sol-gel. Using the known processes to dry a monolith in which its smallest dimension (*i.e.*, the distance the liquid had to travel) was large would have lead to uneven or incomplete drying of the monolith. The result would be that internal strains would form within the foam that would lead to cracking and shrinking. Thus, at least one dimension of the foam was required to be small to provide the liquid with a relatively short path to travel. (page 11, lines 16-26).

Accordingly, the Examiner has failed to establish a prima facie case of obvious because the combination of Hrubesh and Coronado does not teach or suggest making a monolithic aerogel in which its smallest dimension is greater than about 3 inches, there was no motivation to modify the references to produce such an aerogel and there was no reasonable expectation of success in producing such an aerogel. Thus, this obviousness rejection should be withdrawn and claims 1 and 2 should be allowed.

Claims 3-16, 19-24, 25-36, 38, 53, 84-85, 90-93, 95-112, 114 and 128

The Examiner has also rejected the remaining group 1 claims as allegedly being obvious over certain cited patents. Applicants traverse these rejections.

Each of these claims depend, directly or indirectly, from claim 1 and/or claim 2. Thus, these claims are allowable for at least the reasons discussed above that claims 1 and 2 are allowable. None of the other cited patents cure the deficiencies of Hrubesh or Coronado, or provide the motivation and reasonable expectation of success that were missing, as discussed above.

Rejection of the Group 2 claims

The Examiner has rejected claims 37, 40, 41, 43-51, 115, 116, 118-126 as allegedly being unpatentable over Hrubesh in view of Kaschmitter. The Examiner acknowledges that Hrubesh does not disclose an organic aerogel comprising acetic acid. Office Action, page 5, paragraph 5. The Examiner states that Kaschmitter teaches an organic aerogel

being treated with "acetic acid" to promote additional crosslinking of the gels.* The Examiner contends that "the acetic acid is making covalent modifications within the aerogel and the aerogel contains the acetic acid too." The Examiner concludes that it would have been obvious to the skilled artisan to "employ acetic acid in the aerogel motivated by the desire to increase the degree of crosslinking and thus stabilize the network." Applicants disagree.

Applicants' invention, as defined by claim 37, is a small pore area material comprising acetic acid; and as defined by claims 40 and 115, is a small pore area material or a low density microcellular material comprising a carboxylic acid as a solvent. In other words, the small pore area material and the low density microcellular material products themselves must include acetic acid or a carboxylic acid. As detailed below, Hrubesh and Kaschmitter do not teach products containing acetic acid or a carboxylic acid, as required by applicants' claims. Nor is there a motivation to combine the reference teachings to arrive at applicants' claims. Thus, the Examiner has failed to establish a prima facie case of obviousness.

As an initial matter, it was applicants' discovery that the use of a carboxylic acid solvent constitutes a cross-linking mechanism by providing a complex between the hydroxylated aromatics and the carboxylic acid (page 17, lines 15-30; page 28, line 28 – page 30, line 4). At the time of applicants' discovery, only covalent crosslinking, formed between molecules of the small pore area material, was known. It was also applicants' discovery that such carboxylic acid cross-linking results in a more robust sol-gel which is relatively more

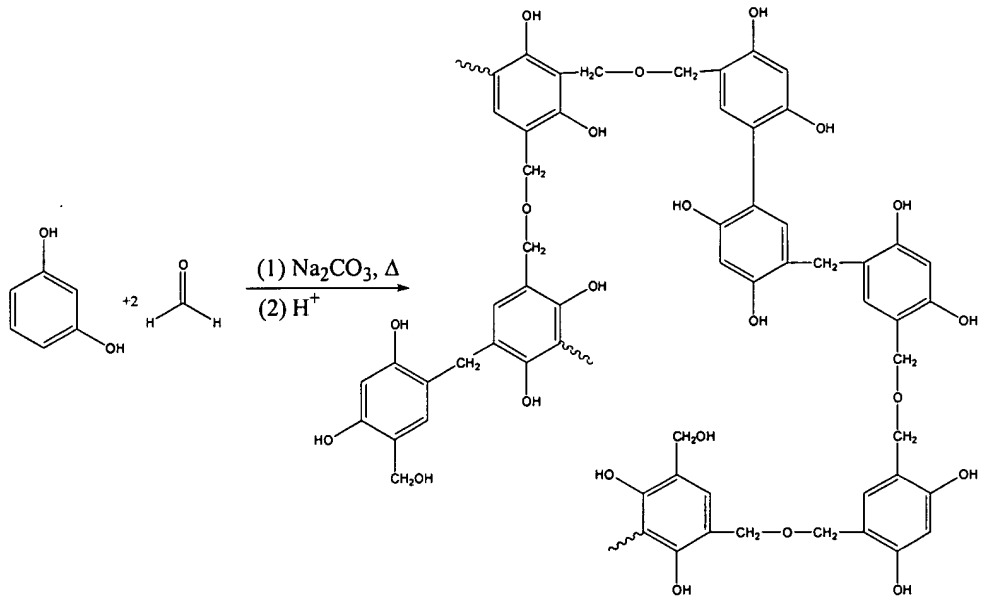
* Applicants believe that the Examiner intended to state that Kaschmitter teaches the use of trifluoroacetic acid rather than acetic acid.

tolerant of stresses from evaporative, centrifugal, gas pressure or vacuum drying methods than are prior art sol-gels. Prior to applicants' discoveries, such benefits were not known and, thus, could not have motivated one to combine the references as the Examiner suggests. *See* MPEP § 2143.

Next, neither Hrubesh nor Kaschmitter teaches or suggests a small pore area material comprising acetic acid, let alone the benefits of carboxylic acid cross-linking. As discussed above, Hrubesh teaches a method of creating hydrophobic aerogels by treating pre-formed aerogels with a surface modifying agent. Also as discussed above, Kaschmitter teaches a method of making carbon aerogels. The aerogels used in Hrubesh and Kaschmitter are prepared according to the Pekala patents. In these methods, the aerogel is either (a) formed in a water solvent and then treated with an acid-wash, or (b) formed in propanol in the presence of an acid catalyst, such as toluenesulfonic acid, phosphoric acid or QUACORR 2001 (*i.e.,* non-carboxylic acids). See, e.g., Hrubesh, col. 3, lines 40-48, Kaschmitter, col. 8, lines 30-31 and col. 10, Example 5, and the '878 patent, col. 4, lines 37-48.

As detailed above, Hrubesh and Kaschmitter, and the documents cited therein, only mention any carboxylic acid in the context of an acid-wash step on the pre-formed aerogel. In that acid-wash step, a carboxylic acid is used merely as a catalyst to promote further crosslinking in the areogel, ***after*** the gel is formed. See, e.g., Kaschmitter, Example 5.

The Pekala '218 patent provides the following scheme illustrating this synthetic route and the formation of a crosslinked network:



See, *e.g.*, the '218 patent, cols. 5 and 6. As shown in the Pekala scheme, the acid (indicated as H^+) is not incorporated into the final product itself. Rather, H^+, like any other catalyst, is not consumed in the reaction process. Thus, although the ***process*** used to treat the gel uses a carboxylic acid as a catalyst, there is no teaching or suggestion that the ***product*** disclosed comprises the acid, as required in claims 37, 40 and 115.

Accordingly, the combination of Hrubesh and Kaschmitter fail to teach or suggest the aerogels of claims 37, 40 and 115. There is also no motivation to combine their teachings to arrive at applicants' claims. Therefore, claims 37, 40 and 115 are nonobvious over Hrubesh in view of Kaschmitter and thus are allowable. Claims 41, 43-51, 116, 118-126 depend, either directly or indirectly, from claims 37, 40 or 115 and thus, are allowable for at

least the same reasons. Accordingly, applicants request that the Examiner withdraw the rejection under 35 U.S.C. § 103.

The Examiner has also rejected claims 37, 40, 41, 43-51, 115, 116, 118-126 as allegedly being unpatentable over Pekala in view of Kaschmitter. The Examiner acknowledges that Pekala does not disclose a low density microcellular material comprising acetic acid. Office Action, page 8, paragraph 9. The Examiner states that Kaschmitter teaches an organic aerogel being treated with "acetic acid" to promote additional crosslinking of the gels. The Examiner contends that "the acetic acid is making covalent modifications within the aerogel and the aerogel contains the acetic acid too." The Examiner concludes that it would have been obvious to the skilled artisan to "employ acetic acid in the aerogel motivated by the desire to increase the degree of crosslinking and thus stabilize the network." Applicants disagree.

In view of the fact that Kaschmitter does not teach or suggest a low density microcellular material comprising acetic acid, the combination of Pekala and Kaschmitter does not render applicants' claims obvious. Accordingly, applicants request that the Examiner withdraw this rejection under 35 U.S.C. §103(a).

CONCLUSION

In view of the foregoing remarks, applicants respectfully request reconsideration and early allowance of the pending claims in this application.

Respectfully submitted,

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